UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/827,424 | 04/20/2004 | Yuu Inatomi | 43888-314 | 2569 |

7590 07/28/2008

MCDERMOTT, WILL & EMERY
600 13th Street, N.W.
WASHINGTON, DC 20005-3096

| EXAMINER | |
|---|---|
| CHU, HELEN OK | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 1795 | |

| MAIL DATE | DELIVERY MODE |
|---|---|
| 07/28/2008 | PAPER |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/827,424
Filing Date: April 20, 2004
Appellant(s): INATOMI ET AL.

# EXAMINER'S ANSWER

This is in response to the appeal brief filed June 11, 2008 appealing from the Office action mailed January 11, 2008.

### (1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

**6,110,619 Zhang 8-2000**

**Carlier, R. "Electrosynthesis and redox behavior of vinylogous TTF displaying strong conformational changes associated with electron transfers" Electrochimica Acta 46 (2001) 3269-3277**

**L.G. Wade, Jr "Organic Chemistry" Fourth Edition, Chapter 1, pp 1-2**

| | | |
|---|---|---|
| **4,092,463** | **Wurmb et al.** | **5-1978** |
| **4,119,767** | **Beck et al.** | **10-1978** |
| **4,198,476** | **Di Salvo, Jr. et al.** | **4-1980** |
| **4,228,226** | **Christian et al.** | **10-1980** |
| **4,414,090** | **D' Agostino et al.** | **11-1983** |
| **4,463,072** | **Gifford et al.** | **7-1984** |
| **4,535,039** | **Naarman et al.** | **8-1985** |
| **4,652,504** | **Ando** | **3-1987** |
| **4,687,598** | **Varma** | **8-1987** |
| **4,702,977** | **Hiratsuka et al.** | **10-1987** |
| **4,842,963** | **Ross, Jr.** | **6-1989** |

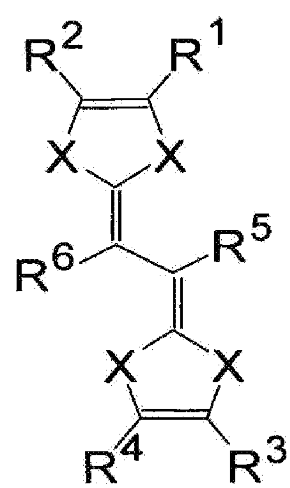
**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

1. Claims 22, 25, 28, 32, 35, 38, 41, 44, 47, 50, 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al. (US Patent 6,110,619) and in view of Carlier et al. (Publication Electrochimica Acta)

2. The Zhang et al. reference teaches a secondary battery (Column 1, Line 37) comprising a positive electrode, a negative electrode and an electrolyte where the positive electrode has an organo-sulfur structure (Column 2, Line 52). The negative electrode active material includes a carbon material and a lithium metal (Column 6, Lines 5-7). The positive electrode active material includes a metal oxide (Column 5, Line 63-64) and is mixed with a conductive material (Column 5, Lines 54-56). The Zhang reference further discloses the electrolyte comprises a solvent where the anion and lithium cation diffuse in and the compound is capable of forming a coordinate bond with the lithium cation by oxidation-reduction reaction (Column 8, Lines 6-22). Some examples of electronically conductive polymers used in sulfur containing solid composite electrodes included polylacetylenes. However, the Zhang et al. reference does not discloses a structure represented by formula (1a). the Carlier et al. reference discloses a structure represented by the following formula:

(1a)



Where X = S, $R_1$ to $R_4$ are methyl or substituted methyl groups. $R_5$ and $R_6$ are hydrogen atoms. Furthermore, Carlier et al. discloses the compound induces fast electron transfer and can control relative stabilities of the different redox species (Conclusion; Pages 3269-3276). Therefore it would have been obvious to one of ordinary skill to use thiafulvalenes as disclosed by Carlier et al. into the secondary battery with organic sulfur electrodes as disclosed by Zhang et al. to increase the electroconductivity. Finally it is known in the art that in a secondary battery the positive and negative electrodes can function interchangeable depending on whether the battery is charging or discharging and therefore the same compounds used for a positive electrode can be used for negative electrodes.

It is noted that claims 50 and 53 are product-by-process claims. "Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F. 2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). Since product is similar to that of the Applicant's, Applicant's process is not given patentable weight in this claim.

**(10) Response to Argument**

Please note when using “Organic Chemistry” and newly submitted prior art references, there are no new rejections presented. The reference submitted is to further clarify the response to Applicants’ newly submitted arguments.

To summarize the Examiner’s position, the Zhang reference discloses all of the claimed elements such as positive electrodes, negative electrodes, and an electrolyte etc. within a secondary battery but most importantly the Zhang reference discloses a broad teaching of electroactive sulfur containing cathode materials which includes carbon-sulfur compound used as an active material (Column 10; 30-50) on the electrodes. In secondary batteries which are also known in the art as rechargeable batteries, the main chemical reaction that takes place is reduction and oxidation reactions (i.e. redox reactions). The Carlier reference discloses a compound with formula 1a displays redox reactions in electrochemical behavior (Page 3270, Lines 3-18) and provides motivation to use the compound of formula 1a in redox reactions because it exhibits fast electron transfers and are relatively stable. Thus, the Applicants’ invention of the rechargeable battery, elements within the rechargeable battery nor carbon-sulfur active materials on the electrode are novel, as it was already found in Zhang reference. Nor did the Applicants invent the compound of formula 1a as the compound was already disclosed by the Carlier reference. Therefore, a patent for a combination, which only unites old elements with no change in their respective functions, obviously withdraws what is already known into the field of its monopoly and diminishes the resources available to skillful men. Where the combination of old elements performed a useful function, but it added nothing to the nature and quality of

the subject matter already patented, the patent failed under §103. When a patent simply arranges old elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement, the combination is obvious. Also, common sense teaches that familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of the patents together like pieces of a puzzle. A person of ordinary skill is also a person of ordinary creativity, not an automaton. The question to be answered is whether the claimed invention is a product of innovation or merely the result of common sense, ordinary creativity, and ordinary skill.

Applicants argue," *Applicants previously replied that the passage of Zhang cited in the Office Action (col. 2, line 52) states that "herein, the term 'organo-sulfur materials' means a material containing organic sulfur compounds with only single or double carbon-sulfur or sulfur-sulfur bonds". It was then argued by Applicants that as the compound of general formula 1 (a) contains carbon-carbon bonds, then compound 1 (a) does not fall into the category of organo-sulfur compounds as defined in the Zhang reference. In fact, nowhere in Zhang is there a mention of the use of a compound of formula 1 (a) as a positive electrode active material*" However, Applicants formula 1(a) contains carbon-carbon bonds in which the Zhang reference also discloses as an embodiment in the cyclic ring structures of Col. 9, Lines 40-50. The Applicants are

misconstruing the disclosure "herein, the term organo-sulfur materials means a material containing organic sulfur compounds with only single or double carbon-sulfur or sulfur-sulfur bonds" by Applicants definition the term “only” is to mean the compound only consist of carbon-sulfur or sulfur-sulfur bonds, however the term “only” can be interpreted in that the compound can only consist of single or double bonds which excludes triple bonds. By disclosure of different embodiments, the Zhang reference surely does not exclude compounds of carbon-carbon bonds, for an example of the carbon cyclic repeating groups (Col. 11, Lines 15-20), carbon-carbon cyclic rings of Col. 9, Lines 40-50 and Col. 4, Lines 35-50 which includes compounds with carbon-carbon bonds such as diallyldimethylamomonium polyvinyl benzyl trimethyl ammonium salts, trimethyl amine etc.

The Applicant further argues,” *In response to the above-mentioned argument, the Examiner stated that because the term "containing" is used, the phrase means that the only bonds between carbon and sulfur or sulfur and sulfur are single or double, but that the compound can have other bonds as well. As such, the Examiner holds that the tetrathiofulvalene (TTF) compound of Carlier is an "organo-sulfur compound" as described by Zhang*” However, please refer to the evidence in the Organic Chemistry reference in which states the term organo or organic is used within the knowledge of one of ordinary skilled in the art to mean any compound with at least one carbon. The Zhang reference teaches embodiments of carbon with sulfur compounds over organic-sulfur compounds, however the Examiner uses the term “organic sulfur” synonymous to “carbon-sulfur compounds” as evidence by the Organic Chemistry reference. The

Zhang reference broadly teaches an electroactive carbon and sulfur containing cathode material (Col. 10, Lines 32-50) in rechargeable batteries in which the Carlier reference discloses a compound with carbon with sulfur active material undergoing redox reactions. Rechargeable batteries primarily undergo redox reactions wherein reduction is discharging and oxidation is charging. Thus the Zhang reference broadly teaches the use of carbon with sulfur containing active material within rechargeable batteries and the Carlier reference teaches a specific carbon and sulfur active material that is capable of being applied to a rechargeable battery because it undergoes redox reactions.

The Applicant's argue, "*In response to this allegation, Applicants would point out that Zhang describes that these "organo-sulfur" compounds "undergo polymerization (dimerization) and de-polymerization (disulfide cleavage) upon the formation and breaking of the disulfide bonds...which results in lower molecular weight polymeric and monomeric species, which may dissolve into the electrolyte and cause self- discharge, reduced capacity, and eventually complete cell failure, thereby severely reducing the utility of organo-sulfur materials as a cathode-active material in secondary batteries". Furthermore, Zhang further states that "the organo-sulfur materials typically contain less than 50 weight percent of sulfur...so they have a much lower energy density or specific capacity than elemental sulfur" (see, col. 2, line 63- col. 3, line 14 of Zhang).*

*Moreover, Zhang discloses in col. 10, lines 9-13, the use of an organo-sulfur material in which the electrochemical activity (electrode reaction) involved the formation and breaking of S-S covalent bonds. In contrast, Carlier is silent with regard to the effectiveness of using TTF as an active material for a secondary battery. TTF does not*

*involve S-S bonds in the generation of electrochemical activity*" Again, the Examiner uses the term "organic sulfur" compounds synonymous to "carbon-sulfur" compounds as evidence is provided in the "Organic Chemistry" reference. The Organic Chemistry reference states that any compound containing at least one carbon is considered organic, therefore, one skilled in the art would use the term "organic sulfur" to be synonymous to "carbon-sulfur." It appears the Applicants do not understand this and attempts are made to differentiates organic sulfur from carbon-sulfur. In any event the Examiner does not focus the rejection only on one type of "organic sulfur" materials but the rejection as a whole includes carbon and sulfur compounds. Again the Zhang reference teaches the use of compounds with carbon and sulfur containing active materials in a secondary battery. Secondary batteries inherently undergo redox reactions. The Carlier reference teaches a compound with carbon and sulfur active materials exhibits fast redox reaction and stability in electrochemical behavior. Thus would motivate one skilled in the art to use the compound of formula 1a for redox reactions within electrochemical cells as disclosed by Carlier for use in a secondary battery that also requires redox behavior as disclosed by Zhang. A patent claim can be proved obvious merely by showing that the combination of elements was obvious to try. When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product is not of innovation but of ordinary skill and common sense.

The Applicants argue, "*Accordingly, one skilled in the art would not be persuaded to combine Carlier, which teaches a dimerized material and does not teach or suggest the usefulness of TTF in a secondary battery, with Zhang, which clearly teaches against the use of"organo-sulfur compounds", especially dimerize compounds, in secondary batteries. Thus, Zhang teaches away from the use of a dimerized compound as disclosed in Carlier, as the compound of Carlier would severely reduce the utility of organo-sulfur materials as a cathode-active material in secondary batteries*" However, these are assertions of the Applicants. The disclosure of the Carlier reference with repect to the compound of formula 1a undergoing "redox" reactions and exhibits "electrochemical behavior" would render it obvious to combine the compound with a secondary battery which inherently undergoes redox reactions. In a secondary/rechargeable battery, during discharging the chemical compound is being reduced and during charging the chemical compound is being oxidized. This statement therefore would motivate one ordinary skilled in the art to use the chemical compound as the active material on an electrode of a secondary/rechargeable battery. It is widely known by one of ordinary skilled in the battery art that rechargeable batteries uses "redox" compounds (emphasis added). Evidence is provided by a few prior art references Wurmb et al. (4,092,463), Beck et al. (4,119,767), Di Salvo, Jr. et al. (4,198,476), Christian et al. (4,228,226), D' Agostino et al. (4,414,090), Gifford et al. (4,463,072), Naarman et al. (4,535,039), Ando (4,652,504), Varma (4,687,598), Hiratsuka et al. (4,702,977), Ross, Jr. (4,842,963). Each of these references illustrates the use of redox compounds in rechargeable batteries.

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Helen Chu

/Helen O Chu/

Examiner, Art Unit 1795

Conferees:

/PATRICK RYAN/

Supervisory Patent Examiner, Art Unit 1795

/William Krynski/

Quality Assurance Specialist, TC 1700